ISD Requirements Traceability Matrix Guidelines

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Purpose

The purpose of this document is to provide uniform guidance for the use of Requirements Traceability Matrices to maintain the linkage from the source of each requirement through its decomposition to implementation and verification.

This traceability is required to ensure that all requirements are addressed, and that only what is required is developed. A Traceability Matrix is also useful when conducting impact assessments of requirements, design or other configured item changes.

Scope

This guideline shall be used with the Requirements Development and Requirements Management processes.

Requirements traceability is of particular use for large, complex, and/or mission software projects where changes in requirements can impact project cost and schedule, and the testing of each requirement, including all decomposed requirements, is important.

Guideline

Requirements traceability should:

- Ensure traceability for each level of decomposition performed on the project. In particular:
  - Ensure that every lower level requirement can be traced to a higher level requirement or original source
  - Ensure that every design, implementation, and test element can be traced to a requirement
  - Ensure that every requirement is represented in design and implementation
  - Ensure that every requirement is represented in testing/verification
- Ensure that traceability is used in conducting impact assessments of requirements changes on project plans, activities and work products
- Be maintained and updated as changes occur.
- Be consulted during the preparation of Impact Assessments for every proposed change to the project
- Be planned for, since maintaining the links/references is a labor intensive process that should be tracked/monitored and should be assigned to a project team member
- Be maintained as an electronic document

See Appendix A for illustrative examples of requirements traceability matrices.

Tools and Templates

The following tools are available. Others exist in industry as discussed in the references. Others may exist for the local project.

Name	Description
Requisite Pro (ReqPro)	IBM Rational tool used for Requirements Management. Requisite Pro can import Word documents, and performs impact analysis using traceability matrices.
DOORS	Telelogic Inc. tool used for Requirements Management
Slate	UGS Corp. tool used for System Engineering – including Requirements Management

References

For further information on this topic please see:

- FSW Requirements Document Template for embedded guidance
- Palmer, J. D., "Traceability," *Software Requirements Engineering*, R. H. Thayer and M. Dorfman, eds., Los Alamitos, CA: IEEE Computer Society Press, 1997, pp. 364–374
- Wiegers, Karl E., “Software Requirements”, Second Edition, Microsoft Press, 2003
- Kotonya, Gerald and Sommerville, Ian, “Requirements Engineering Processes and Techniques”, John Wiley & Sons (UK) 1998

Change History

Version	Date	Description of Improvements
1.0	June 1, 2005	Initial approved version by CCB

Appendix A

Illustrative Examples See below for illustrative examples of the type of data that may be maintained by your project:

Example 1

The example below shows the links that are to be maintained. To demonstrate bi-directional traceability evidence of sorting (and use) by each column is to be captured.

Unique Requirement ID	Requirement Description	Design Reference	Module / Configured Item Reference	Release Reference	Test Script Name/Step Number Reference

(Original source: NASA PAL Link)

Instructions	
The above table should be created in a spreadsheet or database such that it may be easily sorted by each column to achieve bi-directional traceability between columns. The unique identifiers for items should be assigned in a hierarchical outline form such that the lower level (more detailed) items can have their lineage traced.	
Unique Requirement ID	The Unique Requirement ID / System Requirement Statement where the requirement is referenced, and/or the unique ID for decomposed requirements
Requirement Description	Enter the description of the requirement (e.g., Change Request description).
Design Reference	Enter the paragraph number where the CR is referenced in the design documentation
Module / Configured Item Reference	Enter the unique identifier of the software module or configured item where the design is realized.
Release Reference	Enter the release/build version number where the requirement is fulfilled
Test Script Name/Step Number Reference	Enter the test script name/step number where the requirement is referenced (e.g., Step 1)

Example 2

Bi-directional Traceability Matrices Between Software Requirements Specification (SRS) and Software Design Document (SDD)

The example below is bi-directional between Requirements and Design components. Additional traceability to modules/code and test is also needed.

(Original Source: Advanced Resistive Exercise Device (ARED) System GFE – Software Design Document, Engineering Directorate, Biomedical Systems Division/EB, Revision C November 2004)

Legend:

1.0 COTS CSC (Computer Software Component)
1.1 User I/F CSC
1.3 OPSLAN I/F CSC
2.0 DAQ I/F CSC
2.1 Data Format/Storage CSC

SRS Requirement	Design Component(s) (CSC's)
3.2.1.1	1.0, 1.1
3.2.1.2	1.0, 1.1
3.2.1.3	1.0, 1.1
3.2.1.4	1.0, 1.1

3.2.1.5	1.0, 1.1
3.2.1.6	1.0, 1.1, 1.3
3.2.1.7	1.0, 1.1
3.2.1.8	1.0, 1.1
3.2.1.9	1.0, 1.1
3.2.1.10	1.0, 1.1
3.2.1.11	1.0, 1.1
3.2.1.12	1.0, 1.1, 2.0
3.2.1.13	1.0, 1.1, 2.0
3.2.1.14	*RESERVED – no requirement*
3.2.1.15	1.0, 1.1
3.2.1.16	1.0, 1.1
3.2.1.17	1.0, 1.1
3.2.1.18	1.1
3.2.1.19	*RESERVED – no requirement*
3.2.1.20	1.1
3.2.1.21	1.1
3.2.2.1	1.0, 1.1
3.2.2.2	1.0, 1.1
3.2.2.3	1.0, 1.1, 2.0
3.2.2.4	1.0, 1.3, 2.0, 2.1
3.2.2.5	1.0, 1.1
3.2.2.6	1.0, 1.1
3.2.2.7	1.0, 1.1
3.2.2.8	1.0, 1.1
3.2.3.1	1.0, 1.1, 1.3
3.2.3.2	1.0, 1.1
3.2.4.1	1.0, 1.1
3.2.4.2	1.0, 1.1, 2.0, 2.1
3.2.4.3	*RESERVED – no requirement*
3.2.4.4	1.0, 1.1, 2.0
3.2.4.5	1.0, 1.1, 2.0
3.2.5.1	*RESERVED – no requirement*
3.2.5.2	1.0, 1.1, 2.0, 2.1
3.2.5.3	1.0, 1.1, 2.0, 2.1
3.2.5.4	1.0, 1.1, 2.0, 2.1
3.2.5.5	1.0
3.2.5.6	1.0, 1.1, 2.0
3.2.5.7	1.0, 1.1, 2.0
3.2.5.8	1.0, 2.0, 2.1
3.2.5.9	1.0, 2.0, 2.1
3.2.5.10	1.0, 2.0, 2.1
3.2.5.11	1.0, 2.0, 2.1
3.2.5.12	1.0, 2.0, 2.1
3.2.5.13	1.0, 1.1, 2.0
3.2.5.14	1.0, 1.1, 2.0

3.2.5.15	1.0, 2.0, 2.1
3.2.5.16	1.0, 2.1
3.2.5.17	1.0, 2.1
3.2.5.18	1.0, 2.1
3.2.6.1	1.0, 2.1
3.2.7.1	1.0, 1.3, 2.1
3.2.7.2	1.0, 2.1
3.2.7.3	1.0, 1.3, 2.1
3.2.7.4	1.0, 1.1, 1.3, 2.0, 2.1
3.2.8.1	1.0, 1.3
3.2.8.2	*Design goal – no Requirement*
3.2.8.3	1.0, 1.3
3.3.1	1.0, 1.3

Design Component(s) (CSC's)	**SRS Requirement**
1.0	3.2.1.1, 3.2.1.2, 3.2.1.3, 3.2.1.4, 3.2.1.5, 3.2.1.6, 3.2.1.7, 3.2.1.8, 3.2.1.9, 3.2.1.10, 3.2.1.11, 3.2.1.12, 3.2.1.13, 3.2.1.15, 3.2.1.16, 3.2.1.17, 3.2.2.1, 3.2.2.2, 3.2.2.3, 3.2.2.4, 3.2.2.5, 3.2.2.6, 3.2.2.7, 3.2.2.8, 3.2.3.1, 3.2.3.2, 3.2.4.1, 3.2.4.2, 3.2.4.4, 3.2.4.5, 3.2.5.2, 3.2.5.3, 3.2.5.4, 3.2.5.5, 3.2.5.6, 3.2.5.7, 3.2.5.8, 3.2.5.9, 3.2.5.10, 3.2.5.11, 3.2.5.12, 3.2.5.13, 3.2.5.14, 3.2.5.15, 3.2.5.16, 3.2.5.17, 3.2.5.18, 3.2.6.1, 3.2.7.1, 3.2.7.2, 3.2.7.3, 3.2.7.4, 3.2.8.1, 3.2.8.3, 3.3.1
1.1	3.2.1.1, 3.2.1.2, 3.2.1.3, 3.2.1.4, 3.2.1.5, 3.2.1.6, 3.2.1.7, 3.2.1.8, 3.2.1.9, 3.2.1.10, 3.2.1.11, 3.2.1.12, 3.2.1.13, 3.2.1.15, 3.2.1.16, 3.2.1.17, 3.2.1.18, 3.2.1.20, 3.2.1.21, 3.2.2.1, 3.2.2.2, 3.2.2.3, 3.2.2.5, 3.2.2.6, 3.2.2.7, 3.2.2.8, 3.2.3.1, 3.2.3.2, 3.2.4.1, 3.2.4.2, 3.2.4.4, 3.2.4.5, 3.2.5.2, 3.2.5.3, 3.2.5.4, 3.2.5.6, 3.2.5.7, 3.2.5.13, 3.2.5.14, 3.2.7.4
1.3	3.2.1.6, 3.2.3.1, 3.2.7.1, 3.2.7.3, 3.2.7.4, 3.2.8.1, 3.2.8.3, 3.3.1
2.0	3.2.1.12, 3.2.1.13, 3.2.2.3, 3.2.2.4, 3.2.4.2, 3.2.4.4, 3.2.4.5, 3.2.5.2, 3.2.5.3, 3.2.5.4, 3.2.5.6, 3.2.5.7, 3.2.5.8, 3.2.5.9, 3.2.5.10, 3.2.5.11, 3.2.5.12, 3.2.5.13, 3.2.5.14, 3.2.5.15, 3.2.7.4
2.1	3.2.2.4, 3.2.4.2, 3.2.5.3, 3.2.5.4, 3.2.5.8, 3.2.5.9, 3.2.5.10, 3.2.5.11, 3.2.5.12, 3.2.5.15, 3.2.5.16, 3.2.5.17, 3.2.5.18, 3.2.6.1, 3.2.7.1, 3.2.7.2, 3.2.7.3, 3.2.7.4